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## United States Department of Agriculture,

## BUREAU OF PLANT INDUSTRY,

Farmers' Cooperative Demonstration Work,

WASHINGTON, D. C.

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AN EFFECTIVE METHOD OF PREVENTING THE EROSION  
OF HILL LANDS.<sup>1</sup>

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The most enduring form of wealth is real estate. The most useful of all real estate is agricultural land. The greatest problem before any country or people to-day is that of the maintenance of good farm land, because upon the producing power of the land must depend any lasting prosperity. Upon the resources of the farm all life depends, and as the world's population grows the question of maintaining and increasing its producing capacity will become of more vital importance.

Any system of management that lessens the producing capacity of land should be looked on with disfavor. The results of such a course are soon felt by every industry in the country. Everyone who has experience, or who has even made observations, knows that when farm lands are reduced in fertility it involves a great deal of time and labor to restore them.

In the cotton-growing States a large percentage of the cultivated land has been allowed to decline in fertility and much of it has reached the state where, in the ordinary phrase, it is termed "worn-out" land.

## CAUSES OF WORN-OUT LAND.

Several causes contribute to produce this condition: (1) The natural formation causes the soil to wash readily unless carefully handled. (2) The long, open winters with frequent torrential rains and the absence of humus or of a cover crop to help hold the soil particles in place. (3) The unwise system of skimming over the land when plowing, with no regard for the lay of the land in making the rows, which are as frequently up and down hill as otherwise. (4) The

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<sup>1</sup> In the preparation of this circular the writer received valuable suggestions from Prof. W. L. Hutchinson, director, Mississippi Agricultural Experiment Station; from Mason Snowden, State agent, Farmers' Cooperative Demonstration Work for Louisiana; and from W. E. Young, local agent for Amite County, Miss. Prof. J. N. Harper, director, South Carolina Agricultural Experiment Station, and J. E. Wemple, district agent of Louisiana, kindly furnished photographs for illustrations.



continual growing of cotton on the same land. Cotton is a clean-culture crop and completely exhausts the store of natural humus, returning but a small proportion of that removed. (5) The last and most important cause to be named here and the one upon which most stress will be laid in this paper is that of drainage, or proper handling of the water.

The general neglect in regard to drainage on most of the cotton farms in the hill sections, where the greater part of the cotton crop is produced, has caused thousands of acres to be abandoned entirely. These lands have become so gullied and worn from bad treatment and heavy rains that their cultivation is no longer profitable. Owing to the sandy loam nature of the topsoil and the clay subsoil underlying it, after the not too abundant original supply of humus is gone, the surface is carried by the heavy rains into the streams and deposited in the lowlands and river beds out of reach of cultivation. Much fertilizer which has been applied to supply the plant food is carried off in the same way before it reaches the plant roots. This waste accounts for the extensive use of fertilizers in some States. Although the poor plowing and unscientific methods of cropping have exhausted the humus so that lands once valuable are now worthless, farms can usually be restored to productiveness quickly and successfully by the right methods.

#### **FIRST STEP TOWARD RECLAMATION.**

Before the best ditching, terracing, or tiling can be done the rough places must be removed, gullies filled, and the land given a good supply of vegetable matter. As humus accumulates, the plowing should be gradually deepened until a good depth of loose dirt is obtained. It is always best to do this work before permanent terraces are laid out, because it is much more difficult to do a good job of terracing unless the field is in order. When this preliminary work has been done it will be found that much of the surplus surface water has thereby been taken care of. On the hillsides and rolling lands, however, additional help will be necessary at times to carry off water from the sudden downpours which characterize many sections of the cotton-growing States.

#### **UNDERGROUND DRAINAGE.**

The ideal method of carrying off either surface or accumulated ground water is by underground drainage, and tiling when properly laid is perhaps the best means. But since there are thousands of small farms where tiling can not be afforded and thousands of others where it could be afforded, perhaps, but will not be used, the next best method must be chosen to help protect the lands until interest can be worked up to the point of adopting a more perfect system.



**HILLSIDE DITCHES.**

Hillside ditches, the remains of which may be seen over all the country, have been found undesirable for various reasons. The main reason for their failure is that they were rarely ever completed, causing frequent breaks, which increased rather than diminished the actual damage. At best they confine the water to such a narrow space that the velocity with which it flows causes serious washing. They are also very troublesome to keep in repair. The space they occupy is a total loss, covering on steep hillsides as much as 25 per cent of the land. When from any cause the ditch becomes clogged and runs over, great damage results, often to the best part of the field. The ditch bank is a regular hotbed for weeds and briars, furnishing seeds enough to infect all the adjoining lands besides taking the food supply from crops in adjacent rows.

**THE TRUE TERRACE.**

A true terrace (fig. 1) is made by throwing all land down hill in breaking, allowing the first furrow to lap on an unbroken space each



FIG. 1.—A properly terraced field.

time, so as to raise the surface at this point as rapidly as possible. It usually requires several years to complete a well-established terrace, and when completed the surface of the intervening space is approximately level with the next step or terrace. The chief objections to this way of protecting land are about the same as those for hillside ditches. There is, however, less waste land than with the ditch, and the amount of space for weeds is reduced one-half. The most serious difficulty on rather steep hills will be in getting teams and machinery from one terrace to another. This difficulty may be met very materially by leaving sufficient space at each end without embankment to enable teams to move from one level to another.

**BROAD GRADED TERRACES.**

Many of our best farmers have found by actual experience that a combination of the hillside ditch and the terrace (fig. 2) will more nearly fill the needs of our lands than anything yet tried. The term "terrace" will, however, be used in the discussion under this heading. The terrace row is laid off by the use of a level, the same as that used for the ditch or the true terrace. A uniform fall of 4 to 8 inches in



100 feet should be allowed on steep lands and proportionately less on rolling lands. This must be changed to meet local conditions. Where the rainfall is heavy, as in many parts of the South, the greater fall is needed. The distance between terraces is also governed by the steepness of the land. On steep hills the fall between them should not exceed 3 feet, while on slightly rolling lands 4 feet may be given. In laying off the line for a terrace the operator should look for a good outlet. On hillsides that slope both ways it is advisable to carry the water in both directions, if outlets can be had. With areas of considerable size and where several depressions are to be gone through before reaching an outlet, it may be necessary to make a straight ditch at one of these natural depressions, carrying the water directly to the main outlet. This ditch will relieve the strain on the terrace and may save damage that would result from attempting to carry the



FIG. 2.—A field showing the combined hillside ditch and terrace.

water all one way by means of long, irregular terraces. Such ditches can be prevented from getting too deep by allowing grass to grow in them or by putting in brush occasionally. The main differences between this and other methods of terracing are in the construction of the dike or embankment and in the uses to which the embankment is put after it is completed. The construction is much easier and more economical than would at first be thought possible. The embankment can be made largely with the plow by lapping on the unbroken ground and throwing furrows toward the center until the desired width is obtained. The width will be governed by the ideas of the maker. A bank wide enough for three rows is preferred. Such a bank allows a center row on top of the embankment with another row on each side. After this bed has been thrown up once, go to the center, and then by lapping as before continue in the same manner until the proper height is reached. If a disk plow is used,



the embankment may be completed at the first operation, as it will turn loose dirt. When ordinary turning plows are used, it may happen that one must wait until the land is settled by rain in order to complete the job. Obstructions will, of course, have to be removed, depressions or gullies filled, and the bank at these points built up and strengthened to correspond to other parts of the terrace. The height as well as the width to which this embankment should be made depends on the depth of rainfall it must withstand. The one important feature is to make it strong enough to stand against any possible emergency.

When the embankments have been completed, run the rows parallel with them. Beginning with the first row on top of each dike, run off in pairs from each side, letting the short rows come in the middle. It has been found best to work in two short rows occasionally before finishing, in order to prevent having all the short rows running out together, which would cause too great an accumulation of water at one point. The intervening short rows should always come in pairs, as this will allow teams to make a round without dragging the cultivator or plow out to the opposite end, as would necessarily be the case if there was only one row. The ends of all short rows should point slightly up grade. Opinion differs as to short rows—some prefer as above, while others prefer having them all come on one side or the other. The rows on the terrace can be cultivated the same as the others, provided the terrace is made with the right grade and is broad enough. This method of terracing leaves no room for a crop of weeds, but utilizes all the land in the field. As each intervening row has some fall, the water will be carried out by it, but so slowly that the greatest amount possible will be taken up by the land before it can run off. Should enough water accumulate to run across the ordinary rows, the terrace rows will check and hold it until it can be gradually taken up by the land or carried slowly to the outlet. A little judgment in plowing will keep dikes from getting too high. No trouble is experienced in running cultivators, mowers, binders, or wagons on the terrace or across the field in any direction. There is no question that this method is better than any one yet used, and any farmer, it matters not how small his farm or limited his means, can practice it. Many of the best farmers in the sand-hill and light-loam sections of Mississippi, Louisiana, and Arkansas are handling their lands by this method.

The writer has had practical experience with all the methods ordinarily used in the past 25 years, and this method of drainage is far ahead of all other surface methods in efficiency of service or economy of construction. The main points are to plan the work properly at the start and to watch all weak places and keep them up, by hand if necessary. All except a small proportion of the construction can easily be done with plows. The scraper may be required in some low places, where sufficient dirt can not be thrown up by the plow.



This plan will be equally effective on pasture lands that have been turned out to be reclaimed. In fact, if terraced well and all the washing checked, such lands will build up very much more rapidly than otherwise.

#### LEVELS FOR LOCATING TERRACES.

The lines of the terrace may be located with a surveyor's transit (fig. 3) or with one of the extensively advertised farm levels (fig. 4),

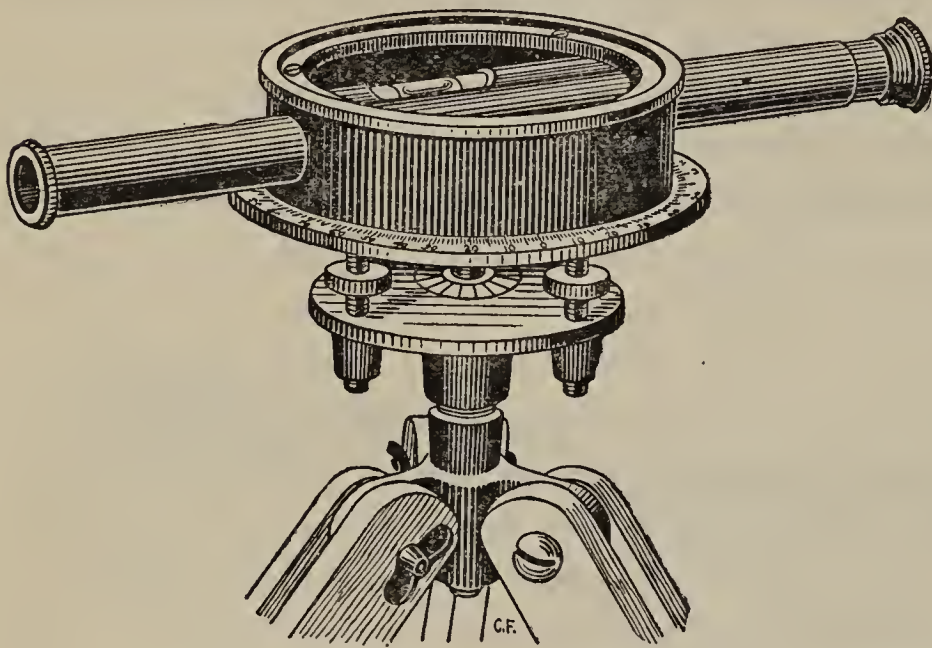


FIG. 3.—A surveyor's transit.

which may be had for \$10 to \$15. If neither of these instruments is available and the farmer does not feel able to invest in one of them, he can, at a cost of \$2, make a substitute (fig. 5) that will do just as accurate work and on very steep lands will answer even better.

Take one piece of

perfectly straight 1 by 3 inch lumber, 16 feet long. Nail to each end of this 16-foot piece an upright piece 1 by 3 inches, 3½ feet long, for legs, and then with two lighter pieces, one-half inch by 3 inches, put braces to extend from near the foot of each leg toward the center of the frame. Be sure that all joints are straight. Attach a 24-inch carpenter's level in the center. Test its accuracy at a level place by reversing the ends

and making adjustments until both are alike. In using this level it will be found convenient to cut an inch off one leg or else tack a 1-inch block on one, to give

proper fall to the terrace line. This gradient may be increased or decreased at will. The work of this cheap and simple outfit will be just as good as that of a \$100 investment, but a greater amount of physical labor for the operator will attend its use.



FIG. 4.—A farm level and target.

#### USE OF THE HOMEMADE LEVEL.

The use of leveling instruments is perhaps so well known that a description is unnecessary, but in order that all may know how to



start from the base line with a frame level the details of its use are here given.

After locating the general outlet for surplus water, begin at a point nearest the top of the hill or ridge where the first terrace is to be established. Place the short-leg end of the level at the point of beginning with the other end in the direction which the line is to follow. Move the forward end up or down grade until the bulb shows level. Then mark the point of beginning by a stake or by digging with a hoe. Move the level forward, placing the back end on the spot where the forward end was; bring the bulb again to the center. Continue until the line is completed. Other lines may be run off in the same way. Much time may be saved by using the hoe instead of a stake for marking, if the line is followed at once by the plow to permanently mark it. A little practice will enable the operator more easily to locate the starting points and also to calculate the distances between terraces. After a little experience the operator will be

able to judge by looking at the land where the level will most likely come, so that time will be saved in finding the proper point. In some localities parties having farm levels go about laying out base lines for anyone in the community for a nominal fee. Where only a limited amount of work is to be done, it might be more desirable to employ them than to get an outfit. The secret of success consists in properly laying out the line as well as in final construction.

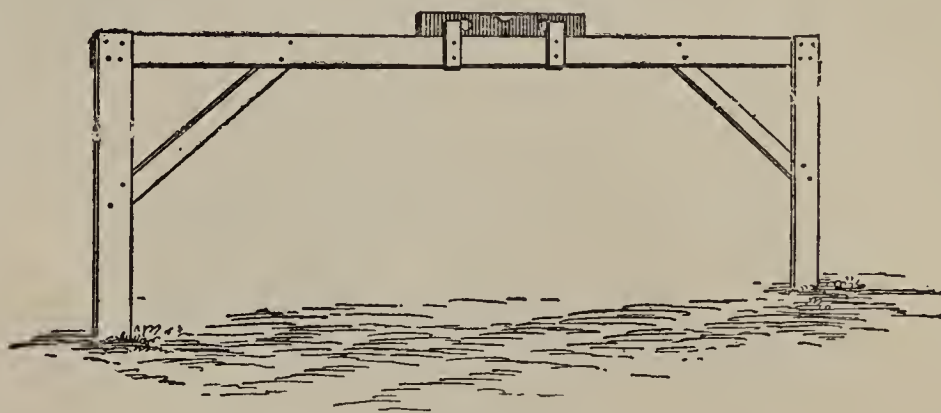


FIG. 5.—A homemade farm level.

Large areas in the Cotton States are badly in need of some method of preventing the land from washing away. It is confidently believed that if this plan of broad terrace rows is adopted, with a wise system of crop rotation, our sandy hill lands may not only be held but improved. After the people more fully realize the importance of caring for their lands, which are their most precious inheritance, it is hoped that they will adopt a better system of underground drainage, which would doubtless do away with the necessity for so much terracing.

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